

TIROS X ATTITUDE SUMMARY

(ORBITS 1-870)

JULY 2, 1965-SEPTEMBER 1, 1965

JAMES R. GREAVES

ARACON GEOPHYSICS DIVISION
ALLIED RESEARCH ASSOCIATES, INC.
CONCORD, MASSACHUSETTS

JUNE 1966

SIXTH TECHNICAL SUMMARY REPORT

UNDER

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GODDARD SPACE FLIGHT CENTER
AERONOMY AND METEOROLOGY DIVISION
GREENBELT, MARYLAND

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SECTION 1

INTRODUCTION

During the first two months of TIROS X operations, ARACON Geophysics was responsible for the determination of satellite attitude via photogrammetric techniques, and for the initial manual reduction of the horizon sensor data. Attitude data processing was performed by ARACON at two Data Acquisition Sites: Wallops Island, Virginia, and Gilmore Creek, Alaska. A daily attitude message was issued containing the results of the photogrammetric attitude reductions. During this period, ARACON also provided a backup gridding capability for the Weather Bureau data utilization center at Suitland, Maryland.

A digital solar aspect indicator similar to that of TIROS IX has replaced the S-9 sensors. These data were used at TTCC to determine the spin vector - sun vector relationship. The TTCC also received the manually reduced horizon sensor data for use in final roll determinations.

The primary attitude determination work was performed by the GSFC Data System Division which received beacon telemetry from the CDA stations. These attitude data as well as the daily ARACON photogrammetric attitude messages, and occasional TTCC horizon sensor results were used as inputs to the grid generation programs at Suitland.

The NASA Computation Center also provided orbital information for the TIROS X satellite. Updated orbital elements were issued approximately once a week after launch. These parameters were, in turn, entered into a CDC-160A computer by ARACON as part of the required inputs for further attitude processing, and grid generation.

SECTION 2

ATTITUDE DETERMINATION

2.1 ATTITUDE PARAMETERS

Orbital coordinates are chosen as the reference system. The XY-plane contains the orbital plane and Z is normal to the orbital plane. The satellite position relative to these axes is given by the true anomaly and its distance from the origin. Satellite attitude is defined by two parameters: the minimum nadir angle, NON, which is the minimum dip angle (between the satellite spin axis and the orbital plane) during an orbital period, and the time of occurrence of the minimum nadir angle, TOT. A more complete description of this coordinate system may be found in Appendix A of Reference 1. On TIROS X, the spin axis is essentially parallel to the optical axis of each camera system (see Fig. 1).

2.2 PICTURE DATA

2.2.1 ARACON Photogrammetric Technique

Under Contract No. NAS5-3953, ARACON has developed a flexible photogrammetric satellite attitude determination system. Any satellite camera system which yields 35 mm film can be accommodated. System hardware is a general-purpose film reader along with formatting and control electronics (Fig. 2). Off-line operation of this equipment produces a paper tape containing raw attitude data. Computer programs have been provided to calculate TIROS attitude parameters with the aid of a Control Data 160-A or IBM 7094. The system was first made operational for the TIROS IX wheel configuration satellite. Since then minor software changes have been made to accommodate TIROS X with its "conventional" camera mount geometry.

The paper tape produced by film reader operation contains several varieties of data, some numerical and some not. The primary numerical data are X-Y coordinates of three different types of data "points": landmarks, horizon points, and matchpoints (common features in pictures with overlapping coverage). These data are obtained by reading the positions of cursors (perpendicular crosswires) centered by an operator over selected image points of cloud pictures displaced on the film reader.

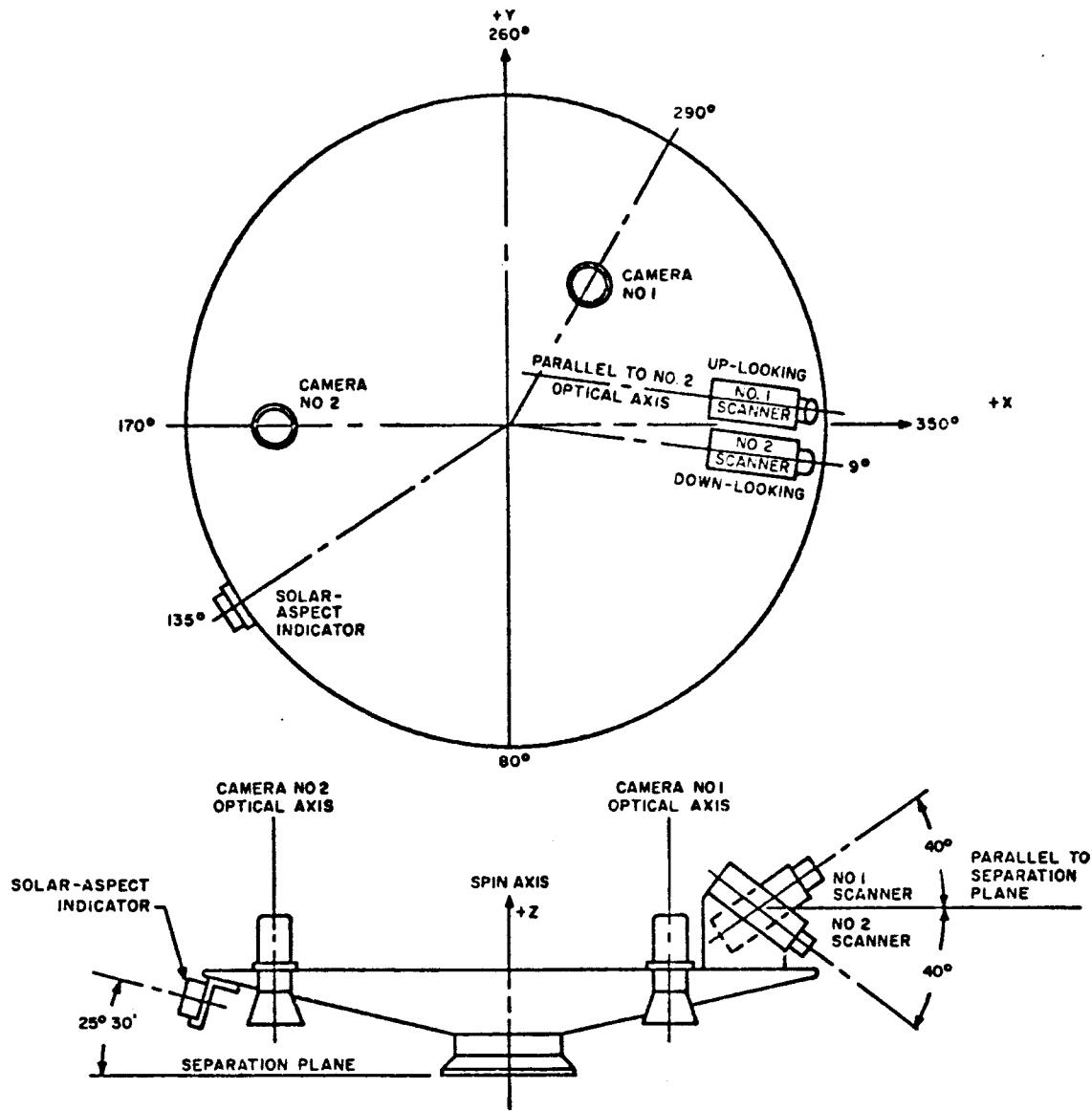
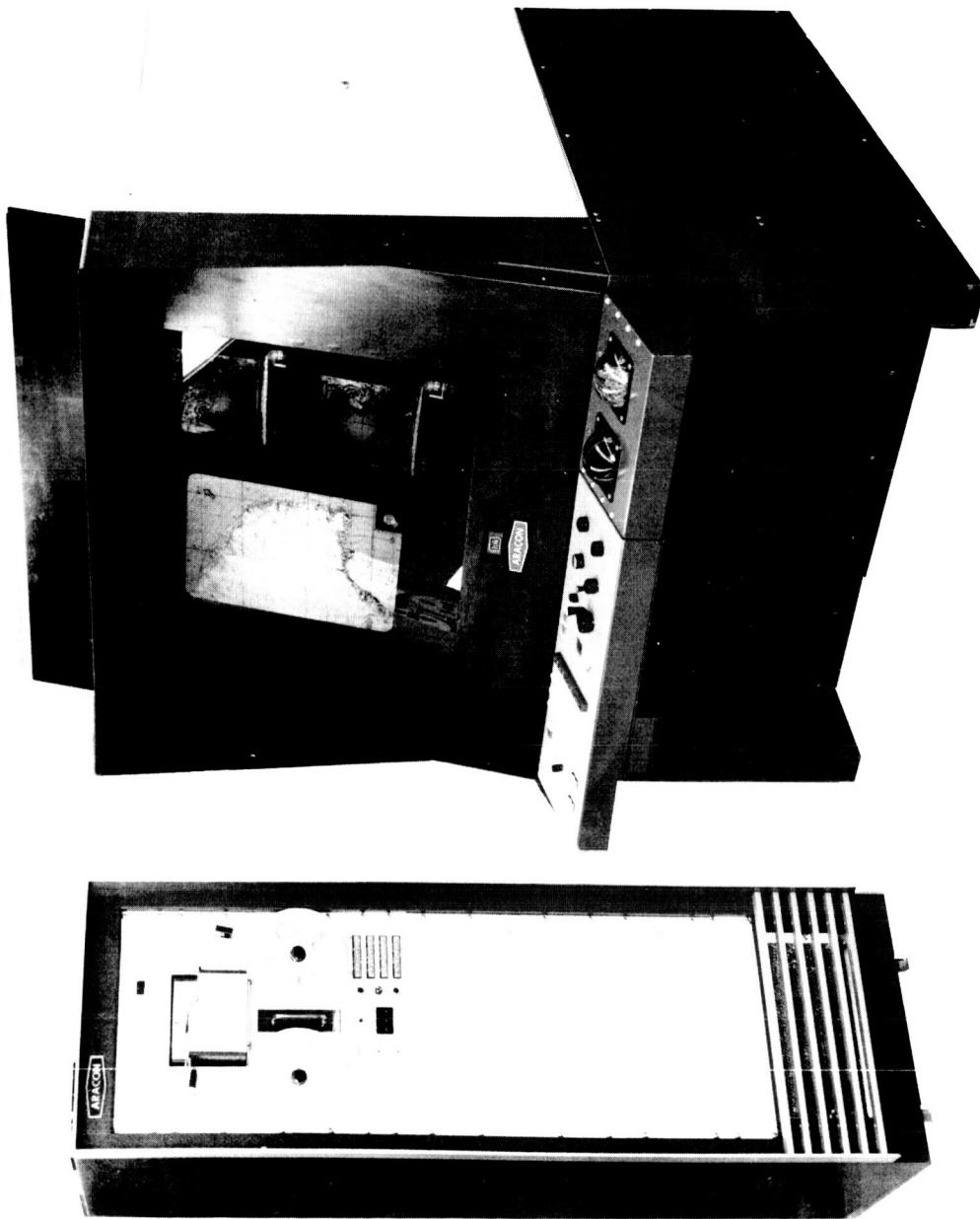


Figure 1. Sensor Configuration

Figure 2 Photogrammetric Attitude System



Two consecutive frames of TIROS 35 mm film appear on the right-hand side of the screen. The upper frame can be rotated 360° by an operator to permit alignment of the two TIROS frames, thereby facilitating matchpoint measurements. The legend of the lower frame is displayed immediately below the frame itself. Landmark maps, on a series of 35 mm slides, are displayed on the left-hand side of the screen.

Two sets of cursors ride immediately behind the plane of the reader. Either set can be positioned at any point on the display screen. A shaft position encoder is mechanically linked to the prism mechanism which rotates the upper TIROS image, providing an indication of image rotation. Additional data sources are a keyboard, and control switches mounted on the control panel of the film reader. Data from the shaft encoders and the control panel are punched onto paper tape through an electronic sequencer.

A feature of the system is programmed control of the sequence of measurements to be made on each cloud picture. The type of point (picture fiducial, landmark, horizon point, etc.) defines the measurement "mode" of the reader. The mode is displayed to an operator from an illuminated display device mounted on the reader control panel. The order of measurement modes is determined by the pin setting of the mode sequence patchboard. After completing operations in a given mode, an operator depresses a mode advance pushbutton. The mode, or type of measurement, is also sequenced onto paper tape with the outputs of the shaft encoders.

A second patchboard allows selection of the various data sources for each type of measurement or mode. Each mode requires somewhat different data to be punched on tape. For instance, when measuring horizon points, data is taken from only the upper picture and the output of shaft encoders for only one crosswire set are needed, whereas matchpoint measurements require readout of both crosswire sets. The patchboard permits selection of the punched data for each of eight types of measurements or modes.

The immediate output of the computer programs are the yaw, roll, and pitch values for the satellite. The inertial spin stabilization of TIROS X introduces a near sinusoidal yaw-roll interchange. By determining the magnitude, and time of occurrence of maximum roll, (Phi-max and lambda for TIROS IX) the conventional TIROS attitude parameters, NON and TOT, may be readily established. A daily attitude message was issued by ARACON indicating the final results of the automated photogrammetric technique. For details of the mathematics, operation, and hardware of the ARACON photogrammetric technique, the reader is referred to References 2, 3, and 4 respectively.

2.2.2 Fujita Photo-Attitude Technique

A photo-attitude technique developed by Fujita (Ref. 5) was initially introduced during the TIROS IV operations. This method involved the determination of the satellite spin axis in the celestial coordinate system (right ascension and declination). The motion of the principal point on the earth and on the image plane are the primary variables. An operational outline of the technique may be found in the above reference. The Fujita photo-attitude technique was an additional attitude analysis method used as a check for the TIROS X operation at Suitland.

2.3 HORIZON SENSOR DATA

On the TIROS X satellite, two horizon scanners are mounted so that as the satellite spins, they sweep out two cones whose axes lie along the positive and negative spin axis. As is seen in Figure 1, each cone has a nominal half angle of 50°.

As the satellite circles the earth, each sensor sees in turn a whole earth scan, alternating sky and earth, whole sky, alternating sky and earth, and finally whole earth again. By recording the relative duration of the earth scan portion of a whole spin (T_E/T_{SPIN}) during the alternating phases of an orbit, a roll history may be generated. The T_E/T_{SPIN} ratios were determined by ARACON and forwarded to TTCC where they were combined with sun angle information to determine magnitude and location of maximum roll, from which the conventional NON and TOT values may be extracted. (see Ref. 6).

SECTION 3

DATA PRESENTATION

The data presented in Appendix A were compiled from NASA's "TIROS X Definitive MGAP" and are shown in tabular form. The control commands used to achieve and maintain proper spacecraft attitude (WOMAX and MBC) are not listed. Figure 3 shows the smoothed progress of $\text{NON}(n_o)$ and $\text{TOT}(t_o)$. The abscissa is the orbit number. Ordinate scales are t_o at the left and n_o at the right. It should be noted that any change in slope is indicative of a corrective change in the torque cycle as directed by a control command.

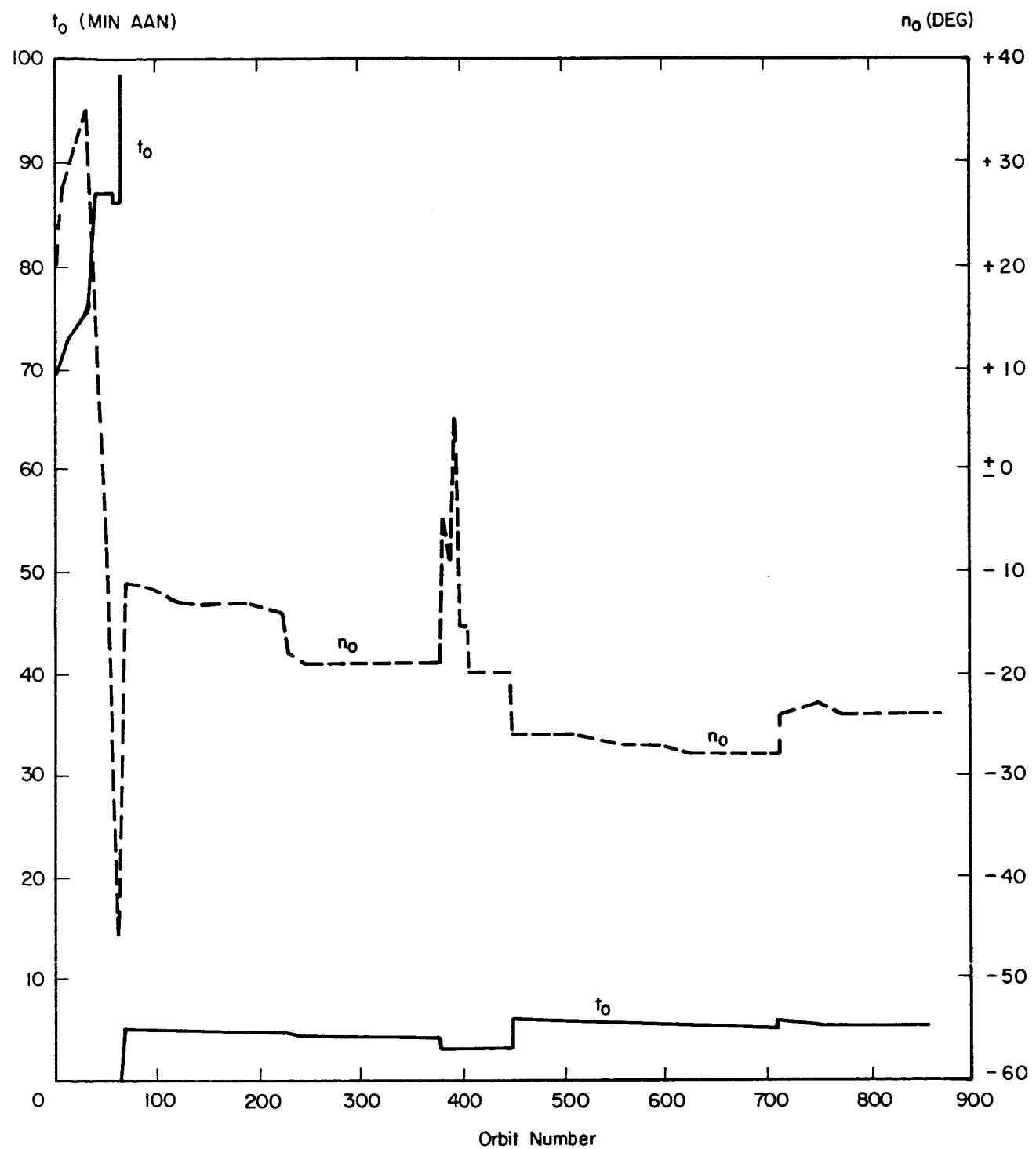


Figure 3 Tiros X Operational Attitude Parameters (n_0, t_0)

APPENDIX A

OPERATIONAL ATTITUDE DATA

A.1 NOMENCLATURE

A word of explanation concerning nomenclature is offered here to potential users attempting to correlate data presented in these tables with TIROS film strips. Some of the documentary literature for TIROS television pictures use two orbit numbers for identifying a film strip (i.e., Ref. 8). As an example, an orbital designation for a film strip such as 91/90 or 91 R/0 90 or 90/91 indicates that pictures were taken during orbit number 90, stored on video tape in the satellite, and were then played back during orbit number 91. Whenever two orbit numbers identify a film strip, and the film strip is designated as "TAPE" mode, the lower orbit number should be used to locate corresponding attitude data. It is also possible to have pictures (DIRECT mode) on the film strip which were obtained during the higher stated orbit number - thus requiring two sets of attitude data for pictures on the film strip.

Errors caused by selecting attitude data for an orbit adjacent to a desired orbit will be negligible for most synoptic analyses. However, selection of inappropriate ascending node data will cause marked discrepancies in location of picture images relative to the earth. Table A-1 provides a brief explanation of the abbreviations appearing in the Header of the Operational Attitude Data of Table A-2.

A.2 TIROS X OPERATIONAL ATTITUDE DATA

The Attitude table (A-2) is divided into two basic sections. Columns "a" through "d" contain data obtained directly from the NASA Computation Center via teletype during the TIROS X operations. Columns "e" and "f" contain the operational attitude parameters.

TABLE A-1
TABLE HEADERS

Column	Header	Explanation
a	Date	Greenwich Mean date on which the ascending node of the orbit in column c occurred.
b	TIROS IX DAY	System Day. Also called J-Day. Day 0 ≡ Launch Day
c	Orbit Number	Labeled consecutively with each vehicular crossing of the earth's equator from south to north. Launch and injection are considered to occur on orbit zero.
d	Ascending Node	Greenwich Mean Time and longitude at which the satellite crossed the equator from south to north.
e	t_o	Attitude parameters in orbital coordinate system. Commonly referred to as TOT (time of occurrence of n_o) and NON (the minimum nadir angle).
f	n_o	t_o stated in minutes after ascending node t_o (Min AAN).

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
July 2, 1965	0	1	084.11E	05 09 52	69.5
"	0	2	058.93E	06 50 35	69.6
"	0	3	033.76E	08 31 18	69.8
"	0	4	008.58E	10 12 00	70.0
"	0	5	016.59W	11 52 43	70.3
"	0	6	041.76W	13 33 26	70.5
"	0	7	066.94W	15 14 08	70.6
"	0	8	092.12W	16 54 51	70.8
"	0	9	117.30W	18 35 34	71.2
"	0	10	142.47W	20 16 16	71.4
"	0	11	167.65W	21 56 59	71.5
July 2, 1965	0	12	167.16E	23 37 42	71.6
July 3, 1965	1	13	141.98E	01 18 25	71.8
"	1	14	116.81E	02 59 07	72.2
"	1	15	091.63E	04 39 50	72.4
"	1	16	066.45E	06 20 33	72.5
"	1	17	041.27E	08 01 15	72.6
"	1	18	016.10E	09 41 58	73.0
"	1	19	009.07W	11 22 41	73.2
"	1	20	034.25W	13 03 23	73.4
"	1	21	059.43W	14 44 06	73.6
"	1	22	084.60W	16 24 49	73.8
"	1	23	109.78W	18 05 31	74.0
"	1	24	134.96W	19 46 14	74.4
"	1	25	160.14W	21 26 57	74.5
July 3, 1965	1	26	174.68E	23 07 39	74.6
July 4, 1965	2	27	149.50E	00 48 22	74.8
"	2	28	124.32E	02 29 05	75.0
"	2	29	099.14E	04 09 47	75.3
"	2	30	073.97E	05 50 30	76.0
"	2	31	048.79E	07 31 13	78.5
July 4, 1965	2	32	023.61E	09 11 55	79.5

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
July 4, 1965	2	33	001.55W	10 52 38	81.5
"	2	34	026.73W	12 33 21	83.5
"	2	35	051.91W	14 14 04	84.5
"	2	36	077.09W	15 54 46	87.0
"	2	37	102.26W	17 35 29	87.0
"	2	38	127.44W	19 16 12	87.0
"	2	39	152.62W	20 56 54	87.0
July 4, 1965	2	40	177.80W	22 37 37	87.0
July 5, 1965	3	41	157.02E	00 18 20	87.0
"	3	42	131.84E	01 59 02	87.0
"	3	43	106.66E	03 39 45	87.0
"	3	44	081.48E	05 20 28	87.0
"	3	45	056.31E	07 01 10	87.0
"	3	46	031.13E	08 41 53	87.0
"	3	47	005.95E	10 22 36	87.0
"	3	48	019.22W	12 03 18	87.0
"	3	49	044.39W	13 44 01	87.0
"	3	50	069.57W	15 24 44	87.0
"	3	51	094.75W	17 05 27	87.0
"	3	52	119.93W	18 46 09	87.0
"	3	53	145.10W	20 26 52	87.0
"	3	54	170.28W	22 07 35	87.0
July 5, 1965	3	55	164.53E	23 48 17	87.0
July 6, 1965	4	56	139.35E	01 29 00	86.0
"	4	57	114.18E	03 09 43	86.0
"	4	58	089.00E	04 50 25	86.0
"	4	59	063.82E	06 31 08	86.0
"	4	60	038.64E	08 11 51	86.0
"	4	61	013.47E	09 52 33	86.0
"	4	62	011.70W	11 33 16	98.0
"	4	63	036.88W	13 13 59	0.8
July 6, 1965	4	64	062.06W	14 54 41	2.4
					-36.7

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e _{t_o} Time (GMT) (Hr Min Sec)	f _{n_o} (Min AAN)	f (Deg)
July 6, 1965	4	65	087.23W	16 35 24	4.2	-30.0
"	4	66	112.41W	18 16 07	4.8	-23.0
"	4	67	137.59W	19 56 49	4.8	-15.7
"	4	68	162.77W	21 37 32	4.8	-11.0
July 6, 1965	4	69	172.05E	23 18 15	4.8	-11.0
July 7, 1965	5	70	146.87E	00 58 58	4.8	-11.0
"	5	71	121.69E	02 39 40	4.8	-11.0
"	5	72	096.51E	04 20 23	4.8	-11.0
"	5	73	071.34E	06 01 06	4.8	-11.0
"	5	74	046.16E	07 41 48	4.8	-11.0
"	5	75	020.98E	09 22 31	4.8	-11.0
"	5	76	004.19W	11 03 14	4.8	-11.0
"	5	77	029.36W	12 43 56	4.8	-11.1
"	5	78	054.54W	14 24 39	4.8	-11.1
"	5	79	079.72W	16 05 22	4.8	-11.1
"	5	80	104.90W	17 46 04	4.8	-11.2
"	5	81	130.07W	19 26 47	4.8	-11.2
"	5	82	155.25W	21 07 30	4.8	-11.2
July 7, 1965	5	83	179.56E	22 48 13	4.8	-11.2
July 8, 1965	6	84	154.38E	00 28 55	4.8	-11.3
"	6	85	129.21E	02 09 38	4.8	-11.4
"	6	86	104.03E	03 50 21	4.8	-11.4
"	6	87	078.85E	05 31 03	4.8	-11.4
"	6	88	053.68E	07 11 46	4.8	-11.5
"	6	89	028.50E	08 52 29	4.8	-11.5
"	6	90	003.32E	10 33 11	4.8	-11.5
"	6	91	021.85W	12 13 54	4.8	-11.6
"	6	92	047.02W	13 54 37	4.8	-11.6
"	6	93	072.20W	15 35 19	4.8	-11.7
"	6	94	097.38W	17 16 02	4.8	-11.7
"	6	95	122.56W	18 56 45	4.8	-11.8
July 8, 1965	6	96	147.74W	20 37 28	4.8	-11.8

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
July 8, 1965	6	97	172. 91W	22 18 10	4. 8
July 8, 1965	6	98	161. 90E	23 58 53	4. 8
July 9, 1965	7	99	136. 72E	01 39 36	4. 9
"	7	100	111. 55E	03 20 18	4. 9
"	7	101	086. 37E	05 01 01	4. 9
"	7	102	061. 19E	06 41 44	4. 9
"	7	103	036. 01E	08 22 26	4. 9
"	7	104	010. 84E	10 03 09	4. 9
"	7	105	014. 33W	11 43 52	4. 9
"	7	106	039. 51W	13 24 34	4. 9
"	7	107	064. 69W	15 05 17	4. 9
"	7	108	089. 86W	16 46 00	4. 9
"	7	109	115. 04W	18 26 43	4. 9
"	7	110	140. 22W	20 07 25	4. 9
"	7	111	165. 40W	21 48 08	4. 9
July 9, 1965	7	112	169. 42E	23 28 51	4. 9
July 10, 1965	8	113	144. 24E	01 09 33	4. 9
"	8	114	119. 06E	02 50 16	4. 9
"	8	115	093. 88E	04 30 59	4. 9
"	8	116	068. 71E	06 11 41	4. 9
"	8	117	043. 53E	07 52 24	4. 9
"	8	118	018. 35E	09 33 07	4. 9
"	8	119	006. 82W	11 13 49	4. 9
"	8	120	031. 99W	12 54 32	4. 9
"	8	121	057. 17W	14 35 15	4. 9
"	8	122	082. 35W	16 15 58	4. 9
"	8	123	107. 53W	17 56 40	4. 9
"	8	124	132. 70W	19 37 23	4. 9
"	8	125	157. 88W	21 18 06	4. 9
July 10, 1965	8	126	176. 93E	22 58 48	4. 9
July 11, 1965	9	127	151. 75E	00 39 31	4. 9
July 11, 1965	9	128	126. 58E	02 20 14	4. 9

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
July 11, 1965	9	129	101.40E	04 00 56	4.9
"	9	130	076.22E	05 41 39	4.9
"	9	131	051.04E	07 22 22	4.9
"	9	132	025.87E	09 03 04	4.9
"	9	133	000.69E	10 43 47	4.9
"	9	134	024.48W	12 24 30	4.9
"	9	135	049.66W	14 05 13	4.9
"	9	136	074.83W	15 45 55	4.9
"	9	137	100.01W	17 26 38	4.9
"	9	138	125.19W	19 07 21	4.9
"	9	139	150.37W	20 48 03	4.9
July 11, 1965	9	140	175.54W	22 28 46	4.9
July 12, 1965	10	141	159.27E	00 09 29	4.9
"	10	142	134.09E	01 50 12	4.9
"	10	143	108.91E	03 30 54	4.9
"	10	144	083.74E	05 11 37	4.9
"	10	145	058.56E	06 52 20	4.9
"	10	146	033.38E	08 33 02	4.9
"	10	147	008.20E	10 13 45	4.9
"	10	148	016.96W	11 54 28	4.9
"	10	149	042.14W	13 35 10	4.9
"	10	150	067.32W	15 15 53	4.9
"	10	151	092.50W	16 56 36	4.9
"	10	152	117.67W	18 37 18	4.9
"	10	153	142.85W	20 18 01	4.9
"	10	154	168.03W	21 58 44	4.9
July 12, 1965	10	155	166.78E	23 39 27	4.9
July 13, 1965	11	156	141.61E	01 20 09	4.8
"	11	157	116.43E	03 00 52	4.8
"	11	158	091.25E	04 41 35	4.8
"	11	159	066.07E	06 22 17	4.8
July 13, 1965	11	160	040.90E	08 03 00	4.8

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
July 13, 1965	11	161	015.72E	09 43 43	4.8 -13.0
"	11	162	009.45W	11 24 25	4.8 -13.0
"	11	163	034.63W	13 05 08	4.8 -13.0
"	11	164	059.80W	14 45 51	4.8 -13.0
"	11	165	084.98W	16 26 34	4.8 -13.0
"	11	166	110.16W	18 07 16	4.8 -13.0
"	11	167	135.34W	19 47 59	4.8 -13.0
"	11	168	160.51W	21 28 42	4.8 -13.0
July 13, 1965	11	169	174.30E	23 09 24	4.8 -13.0
July 14, 1965	12	170	149.12E	00 50 07	4.8 -13.0
"	12	171	123.94E	02 30 50	4.8 -13.0
"	12	172	098.77E	04 11 32	4.8 -13.0
"	12	173	073.59E	05 52 15	4.8 -13.0
"	12	174	048.41E	07 32 58	4.8 -13.0
"	12	175	023.23E	09 13 41	4.8 -13.0
"	12	176	001.93W	10 54 23	4.8 -13.0
"	12	177	027.11W	12 35 06	4.8 -13.0
"	12	178	052.29W	14 15 49	4.8 -13.0
"	12	179	077.47W	15 56 31	4.8 -13.0
"	12	180	102.64W	17 37 14	4.8 -13.0
"	12	181	127.82W	19 17 57	4.8 -13.0
"	12	182	153.00W	20 58 40	4.8 -13.0
July 14, 1965	12	183	178.18W	22 39 22	4.8 -13.0
July 15, 1965	13	184	156.64E	00 20 05	4.8 -13.0
"	13	185	131.46E	02 00 48	4.8 -13.0
"	13	186	106.28E	03 41 30	4.8 -13.1
"	13	187	081.10E	05 22 13	4.8 -13.1
"	13	188	055.93E	07 02 56	4.8 -13.1
"	13	189	030.75E	08 43 38	4.8 -13.2
"	13	190	005.57E	10 24 21	4.8 -13.2
"	13	191	019.60W	12 05 04	4.8 -13.2
July 15, 1965	13	192	044.77W	13 45 47	4.8 -13.3

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
July 15, 1965	13	193	069.95W	15 26 29	4.8 -13.3
"	13	194	095.13W	17 07 12	4.8 -13.3
"	13	195	120.31W	18 47 55	4.8 -13.4
"	13	196	145.48W	20 28 37	4.8 -13.4
"	13	197	170.66W	22 09 20	4.8 -13.4
July 15, 1965	13	198	164.15E	23 50 03	4.8 -13.4
July 16, 1965	14	199	138.97E	01 30 45	4.8 -13.5
"	14	200	113.80E	03 11 28	4.8 -13.5
"	14	201	088.62E	04 52 11	4.8 -13.5
"	14	202	063.44E	06 32 54	4.8 -13.5
"	14	203	038.26E	08 13 36	4.8 -13.5
"	14	204	013.09E	09 54 19	4.8 -13.5
"	14	205	012.08W	11 35 02	4.8 -13.5
"	14	206	037.26W	13 15 44	4.8 -13.6
"	14	207	062.44W	14 56 27	4.8 -13.6
"	14	208	087.61W	16 37 10	4.8 -13.6
"	14	209	112.79W	18 17 52	4.8 -13.7
"	14	210	137.97W	19 58 35	4.8 -13.7
"	14	211	163.15W	21 39 18	4.8 -13.7
July 16, 1965	14	212	171.67E	23 20 01	4.8 -13.8
July 17, 1965	15	213	146.49E	01 00 43	4.8 -13.9
"	15	214	121.31E	02 41 26	4.8 -13.9
"	15	215	096.13E	04 22 09	4.8 -13.9
"	15	216	070.96E	06 02 51	4.8 -13.9
"	15	217	045.78E	07 43 34	4.8 -14.0
"	15	218	020.60E	09 24 17	4.8 -14.0
"	15	219	004.57W	11 05 00	4.8 -14.0
"	15	220	029.74W	12 45 42	4.8 -14.0
"	15	221	054.92W	14 26 25	4.8 -14.0
"	15	222	080.10W	16 07 08	4.7 -15.0
"	15	223	105.28W	17 47 50	4.6 -16.0
July 17, 1965	15	224	130.45W	19 28 33	4.5 -16.3

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
July 17, 1965	15	225	155.63W	21 09 16	4.4
July 17, 1965	15	226	179.18E	22 49 58	4.4
July 18, 1965	16	227	154.00E	00 30 41	4.4
"	16	228	128.83E	02 11 24	4.4
"	16	229	103.65E	03 52 07	4.4
"	16	230	078.47E	05 32 49	4.4
"	16	231	053.29E	07 13 32	4.4
"	16	232	028.12E	08 54 15	4.4
"	16	233	002.94E	10 34 57	4.4
"	16	234	022.23W	12 15 40	4.4
"	16	235	047.41W	13 56 23	4.4
"	16	236	072.58W	15 37 06	4.4
"	16	237	097.76W	17 17 48	4.4
"	16	238	122.94W	18 58 31	4.3
"	16	239	148.12W	20 39 14	4.3
July 18, 1965	16	240	173.29W	22 19 56	4.3
July 19, 1965	17	241	161.52E	00 00 39	4.3
"	17	242	136.34E	01 41 22	4.3
"	17	243	111.16E	03 22 04	4.3
"	17	244	085.99E	05 02 47	4.3
"	17	245	060.81E	06 43 30	4.3
"	17	246	035.63E	08 24 13	4.3
"	17	247	010.45E	10 04 55	4.3
"	17	248	014.71W	11 45 38	4.3
"	17	249	039.89W	13 26 21	4.2
"	17	250	065.07W	15 07 03	4.2
"	17	251	090.25W	16 47 46	4.2
"	17	252	115.43W	18 28 29	4.2
"	17	253	140.60W	20 09 12	4.2
"	17	254	165.78W	21 49 54	4.2
July 19, 1965	17	255	169.03E	23 30 37	4.2
July 20, 1965	18	256	143.86E	01 11 20	4.2

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
July 20, 1965	18	257	118. 68E	02 52 03	4.2 -19.0
"	18	258	093. 50E	04 32 45	4.2 -19.0
"	18	259	068. 32E	06 13 28	4.2 -19.0
"	18	260	043. 14E	07 54 11	4.2 -19.0
"	18	261	017. 97E	09 34 54	4.2 -19.0
"	18	262	007. 20W	11 15 36	4.2 -19.0
"	18	263	032. 38W	12 56 19	4.2 -19.0
"	18	264	057. 55W	14 37 02	4.2 -19.0
"	18	265	082. 73W	16 17 44	4.2 -19.0
"	18	266	107. 91W	17 58 27	4.2 -19.0
"	18	267	133. 09W	19 39 10	4.2 -19.0
"	18	268	158. 26W	21 19 53	4.2 -19.0
July 20, 1965	18	269	176. 55E	23 00 35	4.2 -19.0
July 21, 1965	19	270	151. 37E	00 41 18	4.2 -19.0
"	19	271	126. 19E	02 22 01	4.2 -19.0
"	19	272	101. 01E	04 02 43	4.2 -19.0
"	19	273	075. 84E	05 43 26	4.2 -19.0
"	19	274	050. 66E	07 24 09	4.2 -19.0
"	19	275	025. 48E	09 04 52	4.2 -19.0
"	19	276	000. 30E	10 45 34	4.2 -19.0
"	19	277	024. 86W	12 26 17	4.2 -19.0
"	19	278	050. 04W	14 07 00	4.2 -19.0
"	19	279	075. 22W	15 47 42	4.2 -19.0
"	19	280	100. 40W	17 28 25	4.2 -19.0
"	19	281	125. 57W	19 09 08	4.2 -19.0
"	19	282	150. 75W	20 49 51	4.2 -19.0
July 21, 1965	19	283	175. 93W	22 30 33	4.2 -19.0
July 22, 1965	20	284	158. 88E	00 11 16	4.2 -19.0
"	20	285	133. 71E	01 51 59	4.2 -19.0
"	20	286	108. 53E	03 32 41	4.2 -19.0
"	20	287	083. 35E	05 13 24	4.2 -19.0
July 22, 1965	20	288	058. 17E	06 54 07	4.2 -19.0

TABLE A-2
 TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
July 22, 1965	20	289	033.00E	08 34 49	4.2 -19.0
"	20	290	007.82E	10 15 32	4.2 -19.0
"	20	291	017.35W	11 56 15	4.2 -19.0
"	20	292	042.53W	13 36 58	4.2 -19.0
"	20	293	067.70W	15 17 40	4.2 -19.0
"	20	294	092.88W	16 58 23	4.2 -19.0
"	20	295	118.06W	18 39 06	4.2 -19.0
"	20	296	143.24W	20 19 48	4.1 -19.0
"	20	297	168.41W	22 00 31	4.1 -19.0
July 22, 1965	20	298	166.40E	23 41 14	4.1 -19.0
July 23, 1965	21	299	141.22E	01 21 57	4.1 -19.0
"	21	300	116.04E	03 02 39	4.1 -19.0
"	21	301	090.87E	04 43 22	4.1 -19.0
"	21	302	065.69E	06 24 05	4.1 -19.0
"	21	303	040.51E	08 04 47	4.1 -19.0
"	21	304	015.33E	09 45 30	4.1 -19.0
"	21	305	009.83W	11 26 13	4.1 -19.0
"	21	306	035.01W	13 06 56	4.1 -19.0
"	21	307	060.19W	14 47 38	4.1 -19.0
"	21	308	085.37W	16 28 21	4.1 -19.0
"	21	309	110.55W	18 09 04	4.1 -19.0
"	21	310	135.72W	19 49 46	4.1 -19.0
"	21	311	160.90W	21 30 29	4.1 -19.0
July 23, 1965	21	312	173.91E	23 11 12	4.1 -19.0
July 24, 1965	22	313	148.74E	00 51 55	4.1 -19.0
"	22	314	123.56E	02 32 37	4.1 -19.0
"	22	315	098.38E	04 13 20	4.1 -19.0
"	22	316	073.20E	05 54 03	4.1 -19.0
"	22	317	048.03E	07 34 45	4.1 -19.0
"	22	318	022.85E	09 15 28	4.1 -19.0
"	22	319	002.32W	10 56 11	4.1 -19.0
July 24, 1965	22	320	027.50W	12 36 54	4.1 -19.0

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
July 24, 1965	22	321	052. 67W	14 17 36	4.1 -19.0
"	22	322	077. 85W	15 58 19	4.1 -19.0
"	22	323	103. 03W	17 39 02	4.1 -19.0
"	22	324	128. 21W	19 19 44	4.1 -19.0
"	22	325	153. 39W	21 00 27	4.1 -19.0
July 24, 1965	22	326	178. 56W	22 41 10	4.1 -19.0
July 25, 1965	23	327	156. 25E	00 21 53	4.1 -19.0
"	23	328	131. 07E	02 02 35	4.1 -19.0
"	23	329	105. 89E	03 43 18	4.1 -19.0
"	23	330	080. 72E	05 24 01	4.1 -19.0
"	23	331	055. 54E	07 04 43	4.1 -19.0
"	23	332	030. 36E	08 45 26	4.1 -19.0
"	23	333	005. 18E	10 26 09	4.1 -19.0
"	23	334	019. 98W	12 06 51	4.1 -19.0
"	23	335	045. 16W	13 47 34	4.1 -19.0
"	23	336	070. 34W	15 28 17	4.1 -19.0
"	23	337	095. 52W	17 09 00	4.1 -19.0
"	23	338	120. 69W	18 49 42	4.1 -19.0
"	23	339	145. 87W	20 30 25	4.1 -19.0
"	23	340	171. 05W	22 11 08	4.1 -19.0
July 25, 1965	23	341	163. 76E	23 51 51	4.1 -19.0
July 26, 1965	24	342	138. 59E	01 32 33	4.1 -19.0
"	24	343	113. 41E	03 13 16	4.1 -19.0
"	24	344	088. 23E	04 53 59	4.1 -19.0
"	24	345	063. 05E	06 34 41	4.1 -19.0
"	24	346	037. 88E	08 15 24	4.1 -19.0
"	24	347	012. 70E	09 56 07	4.1 -19.0
"	24	348	012. 47W	11 36 50	4.1 -19.0
"	24	349	037. 65W	13 17 32	4.1 -19.0
"	24	350	062. 82W	14 58 15	4.1 -19.0
"	24	351	088. 00W	16 38 58	4.1 -19.0
July 26, 1965	24	352	113. 18W	18 19 40	4.1 -19.0

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o Time (GMT) (Hr Min Sec)	f n_o (Min AAN)	f n_o (Deg)
July 26, 1965	24	353	138.36W	20 00 23	4.1	-19.0
"	24	354	163.53W	21 41 06	4.1	-19.0
July 26, 1965	24	355	171.28E	23 21 49	4.1	-19.0
July 27, 1965	25	356	146.10E	01 02 32	4.1	-19.0
"	25	357	120.92E	02 43 15	4.1	-19.0
"	25	358	095.74E	04 23 57	4.1	-19.0
"	25	359	070.57E	06 04 40	4.1	-19.0
"	25	360	045.39E	07 45 23	4.1	-19.0
"	25	361	020.21E	09 26 06	4.1	-19.0
"	25	362	004.96W	11 06 48	4.1	-19.0
"	25	363	030.13W	12 47 31	4.1	-19.0
"	25	364	055.31W	14 28 14	4.1	-19.0
"	25	365	080.49W	16 08 56	4.1	-19.0
"	25	366	105.67W	17 49 39	4.1	-19.0
"	25	367	130.84W	19 30 22	4.1	-19.0
"	25	368	156.02W	21 11 05	4.1	-19.0
July 27, 1965	25	369	178.79E	22 51 47	4.1	-19.0
July 28, 1965	26	370	153.61E	00 32 30	4.1	-19.0
"	26	371	128.44E	02 13 13	4.1	-19.0
"	26	372	103.26E	03 53 55	4.1	-19.0
"	26	373	078.08E	05 34 38	4.1	-19.0
"	26	374	052.90E	07 15 21	4.1	-19.0
"	26	375	027.73E	08 56 04	4.1	-19.0
"	26	376	002.55E	10 36 46	4.1	-5.0
"	26	377	022.62W	12 17 29	3.1	-5.5
"	26	378	047.80W	13 58 12	3.1	-6.0
"	26	379	072.97W	15 38 54	3.1	-6.2
"	26	380	098.15W	17 19 37	3.1	-6.4
"	26	381	123.33W	19 00 20	3.1	-6.9
"	26	382	148.51W	20 41 03	3.1	-7.0
July 28, 1965	26	383	173.68W	22 21 45	3.1	-7.2
July 29, 1965	27	384	161.13E	00 02 28	3.1	-7.8

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
July 29, 1965	27	385	135.95E	01 43 11	3.1 -8.0
"	27	386	110.77E	03 23 53	3.1 -8.2
"	27	387	085.60E	05 04 36	3.1 -8.8
"	27	388	060.42E	06 45 19	3.1 -7.0
"	27	389	035.24E	08 26 02	3.1 -5.5
"	27	390	010.06E	10 06 44	3.0 -0.5
"	27	391	015.10W	11 47 27	3.0 5.0
"	27	392	040.28W	13 28 10	3.0 2.0
"	27	393	065.46W	15 08 52	3.1 -4.0
"	27	394	090.64W	16 49 35	3.3 -9.0
"	27	395	115.81W	18 30 18	3.4 -15.5
"	27	396	140.99W	20 11 01	3.4 -15.5
"	27	397	166.17W	21 51 43	3.4 -15.5
July 29, 1965	27	398	168.64E	23 32 26	3.4 -15.5
July 30, 1965	28	399	143.47E	01 13 09	3.4 -15.5
"	28	400	118.29E	02 53 51	3.4 -15.5
"	28	401	093.11E	04 34 34	3.4 -15.5
"	28	402	067.93E	06 15 17	3.4 -15.5
"	28	403	042.76E	07 56 00	3.4 -15.5
"	28	404	017.58E	09 36 42	3.4 -15.5
"	28	405	007.59W	11 17 25	3.4 -15.5
"	28	406	032.77W	12 58 08	3.0 -20.0
"	28	407	057.95W	14 38 50	3.0 -20.0
"	28	408	083.12W	16 19 33	3.0 -20.0
"	28	409	108.30W	18 00 16	3.0 -20.0
"	28	410	133.48W	19 40 59	3.0 -20.0
"	28	411	158.66W	21 21 41	3.0 -20.0
July 30, 1965	28	412	176.16E	23 02 24	3.0 -20.0
July 31, 1965	29	413	150.98E	00 43 07	3.0 -20.0
"	29	414	125.80E	02 23 49	3.0 -20.0
"	29	415	100.62E	04 04 32	3.0 -20.0
July 31, 1965	29	416	075.45E	05 45 15	3.0 -20.0

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
July 31, 1965	29	417	050.27E	07 25 58	3.0 -20.0
"	29	418	025.09E	09 06 40	3.0 -20.0
"	29	419	000.08W	10 47 23	3.0 -20.0
"	29	420	025.25W	12 28 06	3.0 -20.0
"	29	421	050.43W	14 08 48	3.0 -20.0
"	29	422	075.61W	15 49 31	3.0 -20.0
"	29	423	100.79W	17 30 14	3.0 -20.0
"	29	424	125.96W	19 10 57	3.0 -20.0
"	29	425	151.14W	20 51 39	3.0 -20.0
July 31, 1965	29	426	176.32W	22 32 22	3.0 -20.0
August 1, 1965	30	427	158.49E	00 13 05	3.0 -20.0
"	30	428	133.32E	01 53 47	3.0 -20.0
"	30	429	108.14E	03 34 30	3.0 -20.0
"	30	430	082.96E	05 15 13	3.0 -20.0
"	30	431	057.78E	06 55 56	3.0 -20.0
"	30	432	032.60E	08 36 38	3.0 -20.0
"	30	433	007.43E	10 17 21	3.0 -20.0
"	30	434	017.74W	11 58 04	3.0 -20.0
"	30	435	042.92W	13 38 46	3.0 -20.0
"	30	436	068.09W	15 19 29	3.0 -20.0
"	30	437	093.27W	17 00 12	3.0 -20.0
"	30	438	118.45W	18 40 55	3.0 -20.0
"	30	439	143.63W	20 21 37	3.0 -20.0
"	30	440	168.80W	22 02 20	3.0 -20.0
August 1, 1965	30	441	166.01E	23 43 03	3.0 -20.0
August 2, 1965	31	442	140.83E	01 23 45	3.0 -20.0
"	31	443	115.65E	03 04 28	3.0 -20.0
"	31	444	090.48E	04 45 11	3.0 -20.0
"	31	445	065.30E	06 25 54	3.0 -20.0
"	31	446	040.12E	08 06 36	3.0 -20.0
"	31	447	014.94E	09 47 19	3.0 -20.0
August 2, 1965	31	448	010.23W	11 28 02	6.1 -26.0

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o Time (GMT) (Hr Min Sec)	f n_o (Min AAN) (Deg)
August 2, 1965	31	449	035.40W	13 08 44	6.1 -26.0
"	31	450	060.58W	14 49 27	6.1 -26.0
"	31	451	085.76W	16 30 10	6.1 -26.0
"	31	452	110.94W	18 10 53	6.1 -26.0
"	31	453	136.11W	19 51 35	6.1 -26.0
"	31	454	161.29W	21 32 18	6.1 -26.0
August 2, 1965	31	455	173.52E	23 13 01	6.1 -26.0
August 3, 1965	32	456	148.35E	00 53 43	6.1 -26.0
"	32	457	123.17E	02 34 26	6.1 -26.0
"	32	458	098.00E	04 15 09	6.1 -26.0
"	32	459	072.82E	05 55 51	6.1 -26.0
"	32	460	047.64E	07 36 34	6.1 -26.0
"	32	461	022.46E	09 17 17	6.1 -26.0
"	32	462	002.70W	10 57 59	6.1 -26.0
"	32	463	027.88W	12 38 42	6.1 -26.0
"	32	464	053.06W	14 19 25	6.1 -26.0
"	32	465	078.24W	16 00 08	6.1 -26.0
"	32	466	103.41W	17 40 50	6.1 -26.0
"	32	467	128.59W	19 21 33	6.1 -26.0
"	32	468	153.77W	21 02 16	6.1 -26.0
August 3, 1965	32	469	178.95W	22 42 59	6.1 -26.0
August 4, 1965	33	470	155.87E	00 23 41	6.1 -26.0
"	33	471	130.69E	02 04 24	6.1 -26.0
"	33	472	105.51E	03 45 07	6.1 -26.0
"	33	473	080.33E	05 25 49	6.1 -26.0
"	33	474	055.16E	07 06 32	6.1 -26.0
"	33	475	029.98E	08 47 15	6.1 -26.0
"	33	476	004.80E	10 27 57	6.1 -26.0
"	33	477	020.37W	12 08 40	6.1 -26.0
"	33	478	045.55W	13 49 23	6.1 -26.0
"	33	479	070.72W	15 30 06	6.1 -26.0
August 4, 1965	33	480	095.90W	17 10 48	6.1 -26.0

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
August 4, 1965	33	481	121.08W	18 51 31	6.1 -26.0
"	33	482	146.26W	20 32 14	6.1 -26.0
"	33	483	171.43W	22 12 56	6.1 -26.0
August 4, 1965	33	484	163.38E	23 53 39	6.1 -26.0
August 5, 1965	34	485	138.20E	01 34 22	5.9 -26.0
"	34	486	113.02E	03 15 05	5.9 -26.0
"	34	487	087.85E	04 55 47	5.9 -26.0
"	34	488	062.67E	06 36 30	5.9 -26.0
"	34	489	037.49E	08 17 13	5.9 -26.0
"	34	490	012.31E	09 57 55	5.9 -26.0
"	34	491	012.85W	11 38 38	5.9 -26.0
"	34	492	038.03W	13 19 21	5.9 -26.0
"	34	493	063.21W	15 00 04	5.9 -26.0
"	34	494	088.39W	16 40 46	5.9 -26.0
"	34	495	113.56W	18 21 29	5.9 -26.0
"	34	496	138.74W	20 02 12	5.9 -26.0
"	34	497	163.92W	21 42 54	5.9 -26.0
August 5, 1965	34	498	170.89E	23 23 37	5.9 -26.0
August 6, 1965	35	499	145.72E	01 04 20	5.9 -26.0
"	35	500	120.54E	02 45 02	5.9 -26.0
"	35	501	095.36E	04 25 45	5.9 -26.0
"	35	502	070.18E	06 06 28	5.9 -26.0
"	35	503	045.01E	07 47 11	5.9 -26.0
"	35	504	019.83E	09 27 53	5.9 -26.0
"	35	505	005.34W	11 08 36	5.9 -26.0
"	35	506	030.52W	12 49 19	5.9 -26.0
"	35	507	055.69W	14 30 01	5.9 -26.0
"	35	508	080.87W	16 10 44	5.9 -26.0
"	35	509	106.05W	17 51 27	5.9 -26.0
"	35	510	131.23W	19 32 10	5.9 -26.0
"	35	511	156.40W	21 12 52	5.9 -26.0
August 6, 1965	35	512	178.41E	22 53 35	5.9 -26.0

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
August 7, 1965	36	513	153.23E	00 34 18	5.9
"	36	514	128.05E	02 15 00	5.9
"	36	515	102.88E	03 55 43	5.9
"	36	516	077.70E	05 36 26	5.9
"	36	517	052.52E	07 17 08	5.9
"	36	518	027.34E	08 57 51	5.9
"	36	519	002.17E	10 38 34	5.9
"	36	520	023.00W	12 19 17	5.9
"	36	521	048.18W	13 59 59	5.9
"	36	522	073.36W	15 40 42	5.9
"	36	523	098.53W	17 21 25	5.9
"	36	524	123.71W	19 02 07	5.8
"	36	525	148.89W	20 42 50	5.8
August 7, 1965	36	526	174.07W	22 23 33	5.8
August 8, 1965	37	527	160.75E	00 04 15	5.8
"	37	528	135.57E	01 44 58	5.8
"	37	529	110.39E	03 25 41	5.8
"	37	530	085.21E	05 06 24	5.8
"	37	531	060.04E	06 47 06	5.8
"	37	532	034.86E	08 27 49	5.8
"	37	533	009.68E	10 08 32	5.8
"	37	534	015.49W	11 49 14	5.8
"	37	535	040.67W	13 29 57	5.8
"	37	536	065.84W	15 10 40	5.8
"	37	537	091.02W	16 51 23	5.8
"	37	538	116.20W	18 32 05	5.8
"	37	539	141.37W	20 12 48	5.8
"	37	540	166.55W	21 53 31	5.8
August 8, 1965	37	541	168.26E	23 34 13	5.8
August 9, 1965	38	542	143.08E	01 14 56	5.8
"	38	543	117.91E	02 55 39	5.8
August 9, 1965	38	544	092.73E	04 36 22	5.8

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
August 9, 1965	38	545	067. 55E	06 17 04	5. 8
"	38	546	042. 37E	07 57 47	5. 8
"	38	547	017. 19E	09 38 30	5. 7
"	38	548	007. 97W	11 19 12	5. 7
"	38	549	033. 15W	12 59 55	5. 7
"	38	550	058. 33W	14 40 38	5. 7
"	38	551	083. 51W	16 21 21	5. 7
"	38	552	108. 68W	18 02 03	5. 7
"	38	553	133. 86W	19 42 46	5. 7
"	38	554	159. 04W	21 23 29	5. 7
August 9, 1965	38	555	175. 77E	23 04 11	5. 7
August 10, 1965	39	556	150. 61E	00 44 54	5. 7
"	39	557	125. 43E	02 25 37	5. 7
"	39	558	100. 25E	04 06 19	5. 7
"	39	559	075. 07E	05 47 02	5. 7
"	39	560	049. 89E	07 27 45	5. 7
"	39	561	024. 72E	09 08 27	5. 7
"	39	562	000. 45W	10 49 10	5. 7
"	39	563	025. 63W	12 29 53	5. 7
"	39	564	050. 81W	14 10 35	5. 7
"	39	565	075. 98W	15 51 18	5. 7
"	39	566	101. 16W	17 32 01	5. 7
"	39	567	126. 34W	19 12 44	5. 7
"	39	568	151. 52W	20 53 26	5. 7
August 10, 1965	39	569	176. 69W	22 34 09	5. 7
August 11, 1965	40	570	158. 12E	00 14 52	5. 6
"	40	571	132. 94E	01 55 34	5. 6
"	40	572	107. 76E	03 36 17	5. 6
"	40	573	082. 59E	05 17 00	5. 6
"	40	574	057. 41E	06 57 42	5. 6
"	40	575	032. 23E	08 38 25	5. 6
August 11, 1965	40	576	007. 05E	10 19 08	5. 6

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
August 11, 1965	40	577	018.11W	11 59 51	5.6
"	40	578	043.29W	13 40 33	5.6
"	40	579	068.47W	15 21 16	5.6
"	40	580	093.65W	17 01 59	5.6
"	40	581	118.82W	18 42 41	5.6
"	40	582	144.00W	20 23 24	5.6
"	40	583	169.18W	22 04 07	5.6
August 11, 1965	40	584	165.63E	23 44 49	5.6
August 12, 1965	41	585	140.46E	01 25 32	5.6
"	41	586	115.28E	03 06 15	5.6
"	41	587	090.10E	04 46 58	5.6
"	41	588	064.92E	06 27 40	5.6
"	41	589	039.75E	08 08 23	5.6
"	41	590	014.57E	09 49 06	5.5
"	41	591	010.60W	11 29 48	5.5
"	41	592	035.77W	13 10 31	5.5
"	41	593	060.95W	14 51 14	5.5
"	41	594	086.13W	16 31 56	5.5
"	41	595	111.31W	18 12 39	5.5
"	41	596	136.49W	19 53 22	5.5
"	41	597	161.66W	21 34 04	5.5
August 12, 1965	41	598	173.15E	23 14 47	5.5
August 13, 1965	42	599	147.97E	00 55 30	5.5
"	42	600	122.79E	02 36 13	5.5
"	42	601	097.62E	04 16 55	5.5
"	42	602	072.44E	05 57 38	5.5
"	42	603	047.26E	07 38 21	5.5
"	42	604	022.08E	09 19 03	5.5
"	42	605	003.08W	10 59 46	5.5
"	42	606	028.26W	12 40 29	5.5
"	42	607	053.44W	14 21 12	5.5
August 13, 1965	42	608	078.62W	16 01 54	5.5

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE		e t_o (Min AAN)	f n_o (Deg)
			Longitude (Deg)	Time (GMT) (Hr Min Sec)		
August 13, 1965	42	609	103.79W	17 42 37	5.5	-27.6
"	42	610	128.97W	19 23 20	5.5	-27.7
"	42	611	154.15W	21 04 02	5.4	-27.7
August 13, 1965	42	612	179.33W	22 44 45	5.4	-27.7
August 14, 1965	43	613	155.49E	00 25 28	5.4	-27.8
"	43	614	130.31E	02 06 10	5.4	-27.8
"	43	615	105.13E	03 46 53	5.4	-27.8
"	43	616	079.95E	05 27 36	5.4	-27.8
"	43	617	054.78E	07 08 18	5.4	-27.9
"	43	618	029.60E	08 49 01	5.4	-27.9
"	43	619	004.42E	10 29 44	5.4	-27.9
"	43	620	020.75W	12 10 27	5.4	-27.9
"	43	621	045.92W	13 51 09	5.4	-28.0
"	43	622	071.10W	15 31 52	5.4	-28.0
"	43	623	096.28W	17 12 35	5.4	-28.0
"	43	624	121.46W	18 53 17	5.4	-28.0
"	43	625	146.63W	20 34 00	5.4	-28.0
"	43	626	171.81W	22 14 43	5.4	-28.0
August 14, 1965	43	627	163.00E	23 55 25	5.4	-28.0
August 15, 1965	44	628	137.82E	01 36 08	5.4	-28.0
"	44	629	112.65E	03 16 51	5.4	-28.0
"	44	630	087.47E	04 57 33	5.4	-28.0
"	44	631	062.29E	06 38 16	5.4	-28.0
"	44	632	037.11E	08 18 59	5.3	-28.0
"	44	633	011.94E	09 59 42	5.3	-28.0
"	44	634	013.23W	11 40 24	5.3	-28.0
"	44	635	038.41W	13 21 07	5.3	-28.0
"	44	636	063.59W	15 01 50	5.3	-28.0
"	44	637	088.76W	16 42 32	5.3	-28.0
"	44	638	113.94W	18 23 15	5.3	-28.0
"	44	639	139.12W	20 03 58	5.3	-28.0
August 15, 1965	44	640	164.30W	21 44 40	5.3	-28.0

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
August 15, 1965	44	641	170.52E	23 25 23	5.3 -28.0
August 16, 1965	45	642	145.34E	01 06 06	5.3 -28.0
"	45	643	120.16E	02 46 48	5.3 -28.0
"	45	644	094.98E	04 27 31	5.3 -28.0
"	45	645	069.81E	06 08 14	5.3 -28.0
"	45	646	044.63E	07 48 57	5.3 -28.0
"	45	647	019.45E	09 29 39	5.3 -28.0
"	45	648	005.72W	11 10 22	5.3 -28.0
"	45	649	030.89W	12 51 05	5.3 -28.0
"	45	650	056.07W	14 31 47	5.3 -28.0
"	45	651	081.25W	16 12 30	5.2 -28.0
"	45	652	106.43W	17 53 13	5.2 -28.0
"	45	653	131.60W	19 33 55	5.2 -28.0
"	45	654	156.78W	21 14 38	5.2 -28.0
August 16, 1965	45	655	178.03E	22 55 21	5.2 -28.0
August 17, 1965	46	656	152.85E	00 36 03	5.2 -28.0
"	46	657	127.68E	02 16 46	5.2 -28.0
"	46	658	102.50E	03 57 29	5.2 -28.0
"	46	659	077.32E	05 38 12	5.2 -28.0
"	46	660	052.14E	07 18 54	5.2 -28.0
"	46	661	026.97E	08 59 37	5.2 -28.0
"	46	662	001.79E	10 40 19	5.2 -28.0
"	46	663	023.38W	12 21 02	5.2 -28.0
"	46	664	048.55W	14 01 45	5.2 -28.0
"	46	665	073.73W	15 42 28	5.2 -28.0
"	46	666	098.91W	17 23 10	5.2 -28.0
"	46	667	124.09W	19 03 53	5.2 -28.0
"	46	668	149.27W	20 44 36	5.2 -28.0
August 17, 1965	46	669	174.44W	22 25 18	5.2 -28.0
August 18, 1965	47	670	160.37E	00 06 01	5.2 -28.0
"	47	671	135.19E	01 46 44	5.1 -28.0
August 18, 1965	47	672	110.02E	03 27 26	5.1 -28.0

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t _o (Min AAN)	f n _o (Deg)
August 18, 1965	47	673	084. 84E	05 08 09	5.1 -28.0
"	47	674	059. 66E	06 48 52	5.1 -28.0
"	47	675	034. 48E	08 29 34	5.1 -28.0
"	47	676	009. 31E	10 10 17	5.1 -28.0
"	47	677	015. 86W	11 51 00	5.1 -28.0
"	47	678	041. 04W	13 31 43	5.1 -28.0
"	47	679	066. 22W	15 12 25	5.1 -28.0
"	47	680	091. 39W	16 53 08	5.1 -28.0
"	47	681	116. 57W	18 33 51	5.1 -28.0
"	47	682	141. 75W	20 14 33	5.1 -28.0
"	47	683	166. 93W	21 55 16	5.1 -28.0
August 18, 1965	47	684	167. 89E	23 35 59	5.1 -28.0
August 19, 1965	48	685	142. 71E	01 16 41	5.1 -28.0
"	48	686	117. 53E	02 57 24	5.1 -28.0
"	48	687	092. 35E	04 38 07	5.1 -28.0
"	48	688	067. 18E	06 18 49	5.1 -28.0
"	48	689	042. 00E	07 59 32	5.1 -28.0
"	48	690	016. 82E	09 40 15	5.1 -28.0
"	48	691	008. 35W	11 20 57	5.0 -28.0
"	48	692	033. 52W	13 01 40	5.0 -28.0
"	48	693	058. 70W	14 42 23	5.0 -28.0
"	48	694	083. 88W	16 23 05	5.0 -28.0
"	48	695	109. 06W	18 03 48	5.0 -28.0
"	48	696	134. 23W	19 44 31	5.0 -28.0
"	48	697	159. 41W	21 25 14	5.0 -28.0
August 19, 1965	48	698	175. 40E	23 05 56	5.0 -28.0
August 20, 1965	49	699	150. 22E	00 46 39	5.0 -28.0
"	49	700	125. 05E	02 27 22	5.0 -28.0
"	49	701	099. 87E	04 08 04	5.0 -28.0
"	49	702	074. 69E	05 48 47	5.0 -28.0
"	49	703	049. 51E	07 29 30	5.0 -28.0
August 20, 1965	49	704	024. 34E	09 10 12	5.0 -28.0

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
August 20, 1965	49	705	000.83W	10 50 55	5.0
"	49	706	026.01W	12 31 38	5.0
"	49	707	051.19W	14 12 20	5.0
"	49	708	076.36W	15 53 03	5.0
"	49	709	101.54W	17 33 46	5.0
"	49	710	126.72W	19 14 28	5.8
"	49	711	151.90W	20 55 11	5.8
August 20, 1965	49	712	177.07W	22 35 54	5.8
August 21, 1965	50	713	157.74E	00 16 36	5.8
"	50	714	132.56E	01 57 19	5.8
"	50	715	107.38E	03 38 02	5.8
"	50	716	082.21E	05 18 44	5.8
"	50	717	057.03E	06 59 27	5.7
"	50	718	031.85E	08 40 10	5.7
"	50	719	006.68E	10 20 52	5.7
"	50	720	018.49W	12 01 35	5.7
"	50	721	043.67W	13 42 18	5.7
"	50	722	068.85W	15 23 00	5.7
"	50	723	094.02W	17 03 43	5.7
"	50	724	119.20W	18 44 26	5.7
"	50	725	144.38W	20 25 09	5.7
"	50	726	169.56W	22 05 51	5.7
August 21, 1965	50	727	165.26E	23 46 34	5.7
August 22, 1965	51	728	140.08E	01 27 17	5.7
"	51	729	114.90E	03 07 59	5.7
"	51	730	089.72E	04 48 42	5.7
"	51	731	064.55E	06 29 25	5.7
"	51	732	039.37E	08 10 07	5.7
"	51	733	014.19E	09 50 50	5.7
"	51	734	010.98W	11 31 33	5.7
"	51	735	036.15W	13 12 15	5.7
August 22, 1965	51	736	061.33W	14 52 58	5.6

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
August 22, 1965	51	737	086.51W	16 33 41	5.6 -23.3
"	51	738	111.69W	18 14 23	5.6 -23.2
"	51	739	136.86W	19 55 06	5.6 -23.2
"	51	740	162.04W	21 35 49	5.6 -23.2
August 22, 1965	51	741	172.77E	23 16 31	5.6 -23.2
August 23, 1965	52	742	147.59E	00 57 14	5.6 -23.1
"	52	743	122.42E	02 37 57	5.6 -23.1
"	52	744	097.24E	04 18 39	5.6 -23.1
"	52	745	072.06E	05 59 22	5.6 -23.1
"	52	746	046.89E	07 40 05	5.6 -23.0
"	52	747	021.71E	09 20 47	5.6 -23.0
"	52	748	003.46W	11 01 30	5.6 -23.0
"	52	749	028.64W	12 42 13	5.6 -23.0
"	52	750	053.81W	14 22 55	5.5 -23.1
"	52	751	078.99W	16 03 38	5.5 -23.1
"	52	752	104.17W	17 44 21	5.5 -23.1
"	52	753	129.35W	19 25 03	5.5 -23.2
"	52	754	154.52W	21 05 46	5.5 -23.2
August 23, 1965	52	755	179.70W	22 46 29	5.5 -23.3
August 24, 1965	53	756	155.13E	00 27 11	5.5 -23.3
"	53	757	129.95E	02 07 53	5.5 -23.4
"	53	758	104.77E	03 48 36	5.5 -23.4
"	53	759	079.59E	05 29 19	5.5 -23.5
"	53	760	054.42E	07 10 01	5.5 -23.5
"	53	761	029.24E	08 50 44	5.5 -23.6
"	53	762	004.06E	10 31 27	5.5 -23.6
"	53	763	021.10W	12 12 09	5.5 -23.7
"	53	764	046.28W	13 52 52	5.5 -23.7
"	53	765	071.46W	15 33 35	5.5 -23.8
"	53	766	096.64W	17 14 17	5.5 -23.8
"	53	767	121.81W	18 55 00	5.5 -23.8
August 24, 1965	53	768	146.99W	20 35 43	5.5 -23.9

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
August 24, 1965	53	769	172.17W	22 16 25	5.5 -23.9
August 24, 1965	53	770	162.64E	23 57 08	5.5 -23.9
August 25, 1965	54	771	137.47E	01 37 51	5.4 -24.0
"	54	772	112.29E	03 18 33	5.4 -24.0
"	54	773	087.11E	04 59 16	5.4 -24.0
"	54	774	061.93E	06 39 59	5.4 -24.0
"	54	775	036.76E	08 20 41	5.4 -24.0
"	54	776	011.58E	10 01 24	5.4 -24.0
"	54	777	013.59W	11 42 07	5.4 -24.0
"	54	778	038.77W	13 22 49	5.4 -24.0
"	54	779	063.94W	15 03 32	5.4 -24.0
"	54	780	089.12W	16 44 15	5.4 -24.0
"	54	781	114.30W	18 24 57	5.4 -24.0
"	54	782	139.48W	20 05 40	5.4 -24.0
"	54	783	164.65W	21 46 23	5.4 -24.0
August 25, 1965	54	784	170.16E	23 27 05	5.4 -24.0
August 26, 1965	55	785	144.98E	01 07 48	5.4 -24.0
"	55	786	119.81E	02 48 31	5.4 -24.0
"	55	787	094.63E	04 29 13	5.4 -24.0
"	55	788	069.45E	06 09 56	5.4 -24.0
"	55	789	044.27E	07 50 39	5.4 -24.0
"	55	790	019.09E	09 31 21	5.4 -24.0
"	55	791	006.07W	11 12 04	5.4 -24.0
"	55	792	031.25W	12 52 47	5.4 -24.0
"	55	793	056.43W	14 33 29	5.4 -24.0
"	55	794	081.60W	16 14 12	5.4 -24.0
"	55	795	106.78W	17 54 55	5.4 -24.0
"	55	796	131.96W	19 35 37	5.4 -24.0
"	55	797	157.14W	21 16 20	5.4 -24.0
August 26, 1965	55	798	177.68E	22 57 03	5.4 -24.0
August 27, 1965	56	799	152.50E	00 37 45	5.4 -24.0
August 27, 1965	56	800	127.32E	02 18 28	5.4 -24.0

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e _{t_o} Time (GMT) (Hr Min Sec)	f _{t_o} (Min AAN)	n _o (Deg)
August 27, 1965	56	801	102.14E	03 59 11	5.4	-24.0
"	56	802	076.97E	05 39 53	5.4	-24.0
"	56	803	051.79E	07 20 36	5.4	-24.0
"	56	804	026.61E	09 01 19	5.4	-24.0
"	56	805	001.43E	10 42 01	5.4	-24.0
"	56	806	023.73W	12 22 44	5.4	-24.0
"	56	807	048.91W	14 03 27	5.4	-24.0
"	56	808	074.09W	15 44 09	5.4	-24.0
"	56	809	099.26W	17 24 52	5.4	-24.0
"	56	810	124.44W	19 05 35	5.4	-24.0
"	56	811	149.62W	20 46 17	5.4	-24.0
August 27, 1965	56	812	174.80W	22 27 00	5.4	-24.0
August 28, 1965	57	813	160.02E	00 07 43	5.4	-24.0
"	57	814	134.84E	01 48 25	5.4	-24.0
"	57	815	109.66E	03 29 00	5.4	-24.0
"	57	816	084.48E	05 09 51	5.4	-24.0
"	57	817	059.31E	06 50 33	5.4	-24.0
"	57	818	034.13E	08 31 16	5.4	-24.0
"	57	819	008.95E	10 11 59	5.4	-24.0
"	57	820	016.22W	11 52 41	5.4	-24.0
"	57	821	041.39W	13 33 24	5.4	-24.0
"	57	822	066.57W	15 14 07	5.4	-24.0
"	57	823	091.75W	16 54 49	5.4	-24.0
"	57	824	116.92W	18 35 32	5.4	-24.0
"	57	825	142.10W	20 16 15	5.4	-24.0
"	57	826	167.28W	21 56 57	5.4	-24.0
August 28, 1965	57	827	167.53E	23 37 40	5.4	-24.0
August 29, 1965	58	828	142.36E	01 18 22	5.4	-24.0
"	58	829	117.18E	02 59 05	5.4	-24.0
"	58	830	092.00E	04 39 48	5.4	-24.0
"	58	831	066.82E	06 20 30	5.4	-24.0
August 28, 1965	58	832	041.64E	08 01 13	5.4	-24.0

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	d ASCENDING NODE Time (GMT) (Hr Min Sec)	e t_o (Min AAN)	f n_o (Deg)
August 29, 1965	58	833	016.47E	09 41 56	5.4	-24.0
"	58	834	008.70W	11 22 38	5.4	-24.0
"	58	835	033.88W	13 03 21	5.4	-24.0
"	58	836	059.05W	14 44 04	5.4	-24.0
"	58	837	084.23W	16 24 46	5.4	-24.0
"	58	838	109.41W	18 05 29	5.4	-24.0
"	58	839	134.59W	19 46 12	5.4	-24.0
"	58	840	159.76W	21 26 54	5.4	-24.0
August 29, 1965	58	841	175.05E	23 07 37	5.4	-24.0
August 30, 1965	59	842	149.87E	00 48 20	5.4	-24.0
"	59	843	124.69E	02 29 02	5.3	-24.0
"	59	844	099.52E	04 09 45	5.3	-24.0
"	59	845	074.34E	05 50 28	5.3	-24.0
"	59	846	049.16E	07 31 10	5.3	-24.0
"	59	847	023.98E	09 11 53	5.3	-24.0
"	59	848	001.18W	10 52 36	5.3	-24.0
"	59	849	026.36W	12 33 18	5.3	-24.0
"	59	850	051.54W	14 14 01	5.3	-24.0
"	59	851	076.72W	15 54 44	5.3	-24.0
"	59	852	101.89W	17 35 26	5.3	-24.0
"	59	853	127.07W	19 16 09	5.3	-24.0
"	59	854	152.25W	20 56 52	5.3	-24.0
August 30, 1965	59	855	177.42W	22 37 34	5.3	-24.0
August 31, 1965	60	856	157.40E	00 18 16	5.3	-24.0
"	60	857	132.22E	01 58 59	5.3	-24.0
"	60	858	107.04E	03 39 42	5.3	-24.0
"	60	859	081.87E	05 20 24	5.3	-24.0
"	60	860	056.69E	07 01 07	5.3	-24.0
"	60	861	031.51E	08 41 50	5.3	-24.0
"	60	862	006.33E	10 22 32	5.3	-24.0
"	60	863	018.83W	12 03 15	5.3	-24.0
August 31, 1965	60	864	044.01W	13 43 58	5.3	-24.0

TABLE A-2
TIROS X OPERATIONAL ATTITUDE DATA

a DATE	b JULIAN DAY	c ORBIT NUMBER	d ASCENDING NODE Longitude (Deg)	e t_o (Min AAN)	f n_o (Deg)
		Time (GMT) (Hr Min Sec)			
August 31, 1965	60	865	069.19W	15 24 40	5.3 -24.0
"	60	866	094.37W	17 05 23	5.3 -24.0
"	60	867	119.54W	18 46 05	5.3 -24.0
"	60	868	144.72W	20 26 48	5.3 -24.0
"	60	869	169.90W	22 07 31	5.3 -24.0
August 31, 1965	60	870	164.92E	23 48 13	5.3 -24.0

APPENDIX B

TIROS X SUBPOINT TRACK

Table B-1 provides a sample of the orbital elements of TIROS X for Epoch 2 July 1965, at 04 20 00 Universal Time.

Figure B-1 serves as an aid in correlating spatial attitude parameters (n_o , t_o) with terrestrial coordinates. The insert of Figure B-1 shows the orbital track of TIROS X as it would appear on a Mercator projection of the earth (the base map).

The subpoint track diagram with one minute hatch marks along the subpoint track can be used to estimate the spatial location of the satellite during the time (referenced to the ascending node) of picture taking. Knowledge of the satellite attitude (obtained from the tables in Appendix A) assists the analyst in mentally orienting himself to the appropriate perspective of the images seen in the TIROS X television pictures. Picture timing data may be obtained from the U.S. Weather Bureau (Ref. 7).

The subpoint track insert operates (in a mechanical sense) similarly to a slide rule. The equator line on the insert should be made coincident with the equator on the base map. The insert may then be moved horizontally until the ascending node of the subpoint track coincides with the ascending node longitude of the desired orbit.

TABLE B-1

SAMPLE ORBITAL ELEMENTS

GAC070A
 PP GACQ GAGO GCPN GHNJ GMOR GNET GSPE GSTS GSWB GTWL
 DE GOSI 071
 02/1500Z
 FM W MORGAN/R ATWOOD TTCC
 TO GSPE/HQS E J DARDEN TECHNICAL ASSISTANT OFFICE OF THE ADMINISTRATOR
 DR TEPPER
 GSTS/DR GOETT CODE 100/DR TOWNSEND
 INFO GSTS/650 SPENCER/BUTLER/RADOS/ATWOOD/OSSERDOFF/MASKASKY
 500 MENGEEL/202 LYNCH/511 ROSSI/535 SANFORD
 GTWL/547 HOHNSON
 GCPN/R GRAY

PAGE ONE OF TWO
 TIROS X SPECIAL PROGRESS REPORT JULY 2 65
 AT 0407Z TIROS X WAS LAUNCHED ON JULY 2, FROM CAPE KENNEDY, IT
 ACHIEVED A 1045 AM SUN SYNCHRONOUS ORBIT.
 OTHER ORBITAL DATA ARE:
 THE FOLLOWING ARE THE ORBITAL ELEMENTS FOR SATELLITE 1965 51-A
 TIROS X COMPUTED FROM MINITRACK OBSERVATIONS AT THE NASA COMPUTING
 CENTER AND ISSUED ON 02 JUL 1965 BY THE GODDARD SPACE FLIGHT CENTER
 EPOCH 65 Y 07 M 02 D AT 04 HOURS 20.00 MIN. UT
 SEMI-MAJOR AXIS 007174.05 KILOMETERS
 ECCENTRICITY 0.00607 DEGREES
 INCLINATION 098.637 DEGREES
 MEAN ANOMALY 295.661 DEGREES
 ARGUMENT OF PERIGEE 245.487 DEG. PER DAY
 MOTION MINUS 02.9283 DEGREES
 R. A. OF ASCEND. NODE 081.573 DEG. PER DAY
 MOTION PLUS 00.9912 MINUTES
 ANOMALISTIC PERIOD 0100.78412 MIN. PER DAY
 MOTION PLUS 0.00000 KILOMETERS
 HEIGHT OF PERIGEE 000752.10 KM. PER HR
 HEIGHT OF APOGEE 000839.23 KM. PER HR
 VELOCITY AT PERIGEE 026999 KM. PER HR
 VELOCITY AT APOGEE 026673 KM. PER HR
 GEOC. LAT. OF PERIGEE -64.099 DEGREES

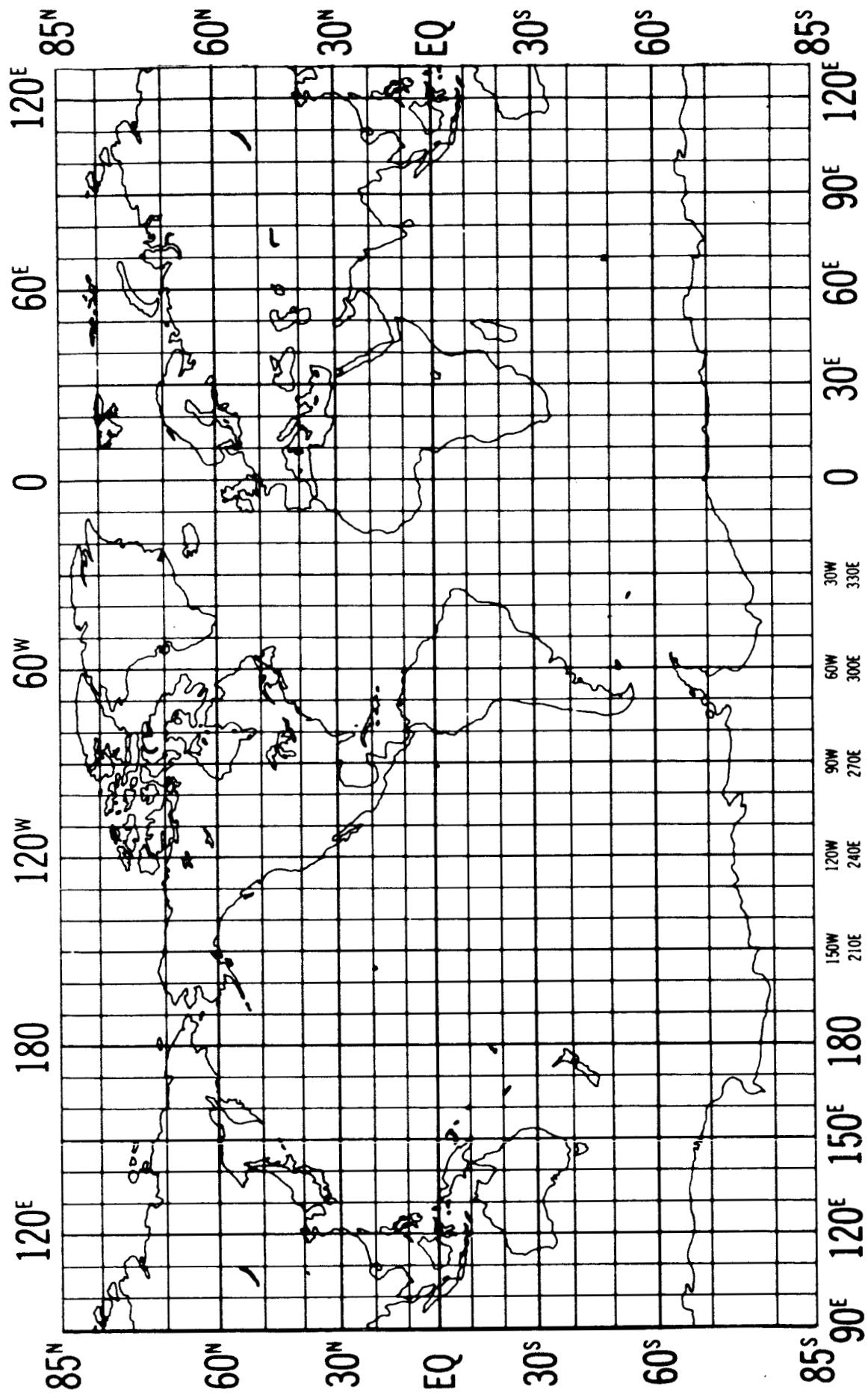


Figure B-1. TIROX X Sub-Point Track

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